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On the distribution, management and conservation of the crested porcupine, *Hystrix cristata* (L.), in Italy

Abstract – This paper summarizes the available information on the history and distribution of the crested porcupine, *Hystrix cristata* (L.), in Italy.

Geological and zoogeographical considerations have led to the conclusion that the crested porcupine was introduced into Italy by man, probably in Roman times, and that its distribution in Europe is restricted to the mainland of Italy and to Sicily. The comparison between the crested porcupine's present and past distribution in Italy indicates that its range has substantially extended northwards and eastwards during the last decades. Widespread poaching is regarded as a serious threat to crested porcupines, particularly in zones of recent colonization. The main difficulty in assessing management options is due to the complete absence of estimate of numbers and population density of porcupines both regionally and nationally. The species is not biologically endangered and the prospect for its long-term survival is good. Particular emphasis is given to the need of collecting ecological and ethological data to allow a correct management of the species.

Riassunto – Sulla distribuzione, gestione e conservazione dell'istrice, *Hystrix cristata* (L.), in Italia.

Viene discussa l'origine e la distribuzione dell'istrice in Europa ed in Italia. Sulla base di considerazioni geologiche e zoogeografiche si conclude che l'istrice sia stato introdotto in Italia dall'uomo, probabilmente in epoca romana, e che la sua distribuzione in Europa sia circoscritta alla penisola italiana ed alla Sicilia. Negli ultimi decenni la distribuzione dell'istrice si è estesa tanto verso nord quanto verso est. Le prospettive per la conservazione dell'istrice in Italia appaiono buone, ma maggiori informazioni sulla biologia di questa specie sono necessarie per definire adeguati piani gestionali a livello nazionale.

Key words: Status, conservation, management, *Hystrix cristata,* Italy.

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Introduction

The crested porcupine, *Hystrix cristata* L., is a large (10-20 kg), nocturnal Hystricomorph rodent included in the list of the European species threatened with extinction (van der Woude et al., 1969). More recently it has been considered one of the top ten endangered rodents in Europe (Pucek, 1989). It has been totally protected throughout the Italian territory since 1974.

The crested porcupine is a common species of the Mediterranean maquis, a relatively undisturbed thick woodland dominated by oaks (*Quercus* spp.). Foraging chiefly on herbaceous plants, roots, tubers, wild and cultivated fruits, this rodent has been included in the list of pest species (Santini, 1983). Our knowledge on the reproductive biology of the crested porcupine is rather scarce but all evidence suggests that its reproductive potential is fairly good. Porcupines breed throughout the year and reach an age of twenty years in captive conditions; females become sexually mature before one year of age and produce two or, more rarely, one young once or twice a year (Mohr, 1965; Niethammer, 1978; Santini, 1980).

All published information on the distribution of the crested porcupine in Italy was reviewed and synthesized to allow the comparison between the current and past distribution. In addition to this material, I contacted several colleagues so as to gather further information on the presence and distribution of crested porcupines in other European countries.

The aim of this paper is to review the available information on the history and previously known distribution of crested porcupine in Italy and to use this as a basis for considerations about the conservation and management of this species.

History

It is widely recognized that crested porcupines have been living in the Italian peninsula since a very remote age. During the Roman age, Plinio il Vecchio, generally recognized as a keen naturalist, described the morphological characteristics of the crested porcupine and its effective defensive technique (Scaramella, 1981). More recently, the crested porcupine has been chosen as the emblem of one of the seventeen quarters of Siena, Tuscany (XIII century). King Louis XII selected the crested porcupine as his personal emblem and had it carved on the portals of the Blois Castle (XV century) (Orsomando & Pedrotti, 1976). Nevertheless, naturalists and zoologists have devoted little attention to crested porcupines, probably because the secretive habits and nocturnal activity of this rodent discouraged observations and field-work.

The review of the available literature clearly shows the wealth of anecdotes and considerable confusion on different aspects of the natural history and biology of this species. Two mutually exclusive theories have been suggested to account for the presence of crested porcupines in the Mediterranean region (namely Italy, see next section). The analysis of fossil deposits demonstrates that porcupines of the genus *Hystrix* were to be found in Europe from the Pliocene to the last interglacial of the Pleistocene (e.g. Mohr, 1965; Bartolomei, 1969). However, studies on the morphological characteristics (i.e. teeth, mandible) of the individuals belonging to the species discovered in the European fossil deposits (e.g. *Hystrix major* and

Hystrix vinogradovi) show that there is no link to be drawn between the one occurring now in Italy and the others (Niethammer, 1978). Thus, crested porcupines must have somehow come from Africa after the end of the last glaciation, using one of the following routes: either easterly or westerly around the Mediterranean Sea, and eventually from Tunisia to Sicily. The eastern route can be discarded on the basis of the fossil deposits, which contain individuals much smaller than *Hystrix cristata* (Mohr, 1965; Niethammer, 1978); similarly, the western route is unlikely, owing to the lack of porcupines in the fossil deposits of the Iberian peninsula dating from the last interglacial (Mohr, 1965). Finally, the hypothesis of a direct arrival of crested porcupines from Africa, at the time when Tunisia was linked to Sicily, can be rejected on geological and zoogeographical grounds (Mohr, 1965). Interestingly, the individuals porcupines occurring in Africa and Italy do not differentiate in subspecies, which suggests that the contacts between these two groups came to an end a relatively short time ago (Mohr, 1965).

The second theory puts forward that crested porcupines were introduced into Europe by man, being probably imported from Africa in Roman times (Niethammer, 1963; Mohr, 1965). It is worth pointing out that the Romans played an important role in the reintroduction of the fallow deer (*Dama dama* L.) in some European countries (e.g. England); moreover Roman traders spread the rabbit (*Oryctolagus cuniculus* L.) around the Mediterranean basin (Lever, 1985). Thus, it seems reasonable to believe that crested porcupines were introduced by the Romans for aesthetic and economic reasons, partly due to the use of their quills as ornaments and to the edibility of the meat (Mohr, 1965; Orsomando & Pedrotti, 1976; Santini, 1980) or just as curiosity (Lever, 1985). According to this theory, the crested porcupine can be regarded as one of the few naturalized mammals to have become successfully established with selfgenerating populations in the wild in Italy.

Distribution

There is a considerable disagreement as far as the distribution of the crested porcupine in Europe is concerned. According to van den Brink (1956), crested porcupines occur in the mainland of Italy and in Sicily, northern Greece, Albania and southern Yugoslavia. Several authors (e.g. Hainard, 1962; Toschi, 1965; Corbet, 1966) have subsequently reported (and hence endorsed) the distribution proposed by van den Brink. Yet, Niethammer (1963) and Mohr (1965) could not find any evidence confirming the presence of crested porcupines in the Balkans, and similarly, albeit a few decades earlier, Müller (1912, cited in Mohr, 1965) did not include any Balkan country in the list of the European areas inhabited by this rodent. More recently, Smit & van Wijngaarden (1976) revealed serious doubts regarding the validity of the distribution earlier proposed by van den Brink (1956) and concluded that «it appears that the crested porcupine is not present in the Balkans». Nevertheless, some authors (e.g. Santini, 1980) subsequently included the Balkans in the list of the European countries currently inhabited by the crested porcupine.

I have therefore contacted some colleagues working in the Balkan region to find out whether *Hystrix cristata* was exhibited in Museum or Uni-

versity collections or possibly mentioned in any local or national Guide of Mammals published in any Balkan country. Kayellis & Chatzisarantos (1968), Ondrias (1968) and Tsunis (1989) did not include the crested porcupine in their list of Mammals of Greece (G. Tsunis, personal communication). Similarly, Djulic & Miric (1967) did not mention the crested porcupine in their Catalogue Faunae Yugoslaviae (Mammalia) and this species is not currently considered as a part of the native fauna in Yugoslavia (B. Dulic, M. Adamic, personal communications). Furthermore, no specimen of *Hystrix cristata* is exhibited in the Macedonian Museum of Natural History in Skopje, but, of even greater importance, no crested porcupine has ever been collected in Macedonia, so that and any information about this species is wholly lacking (B. Krystufek, personal communication). Since the Macedonian territory borders with northern Albania, it seems reasonable to have serious doubts as to the presence of crested porcupines in Albania. The above mentioned information demonstrates that the crested porcupine does not occur in the Balkan region and, therefore, its distribution in Europe should be restricted to the Italian peninsula and Sicily, as suggested by Müller (1912, cited in Mohr, 1965) about eighty years ago.

This situation recalls a case of misinformation about the occurrence of another rodent, the Alpine marmot (*Marmota marmota* L.), in the French Pyrenees (Couturier, 1955). Although it is not clear yet when the Alpine marmot has been erroneously included in the list of the fauna of the French Pyrenees, its presence on these mountains has been persistently reported in numerous publications in the last centuries. Couturier concluded that «it would be certainly easier to remove the cause of the error (i.e. introduce the marmots) than to change people's attitude», and so he did, releasing marmots in those mountains. Hopefully, the present case of misinformation will not require the introduction of crested porcupines in the Balkan countries!

As for the distribution of the crested porcupine in Italy, the first scientific information was provided by Ghigi (1911, 1917) and Altobello (1920). Historically, it appears that the crested porcupine occurred primarily along the regions on the western slope of the peninsula south of the Arno river (Tuscany, Latium, Campania), in Umbria, Abruzzo, Apulia and in the south (Calabria, Basilicata and Sicily). These general indications were also confirmed by a subsequent survey conducted several years later (Ghigi, 1947, 1963). In both surveys it is not mentioned the occurrence of populations of crested porcupine north of the Apennines (in Emilia-Romagna, but see later reports by Zangheri, 1946, 1957, 1969, 1970) and in the regions of the Adriatic coast (Marche, Molise). During the 1960s and first half of the 1970s several reports have documented the presence of crested porcupines north of both the Arno river and the Apennines and on the Adriatic coast (e.g. Silvestri, 1970, 1971; Orsomando & Pedrotti, 1976; Tomei & Cavalli, 1976). However, it is during the second half of the 1970s and in the 1980s that the crested porcupine has significantly extended its range northwards and eastwards (cf. Santini, 1980; Scaramella, 1981; Pandolfi, 1986; Sala, 1987; Ferri & Sala, 1990; Zavalloni et al., 1991). In doing so crested porcupines moved towards some Adriatic coastal areas (e.g. pinewoods of Ravenna, Romagna), where they certainly occurred at the end of the 18th century (Ginanni 1774, cited in Veggiani in press) and in the direction of the Padana Valley (i.e. Province of

Modena, Sala, 1987). It is, however, worth pointing out that Scaramella (1981) also claimed a decline of crested porcupines and their disappearance from some areas in southern Italy and Sicily.

Several reasons have been given to account for increased tendency of the crested porcupine to extend its range during the last decade. Santini (1983) suggested that the absence of specific predators and the recent protection against shooting might be regarded as important factors in bringing about the conditions for the observed extension of the range. According to Pandolfi (1986), habitat changes (e.g. reduction in the cultivation of lands in the range between 400 and 1000 m, increase in the surface covered with forests and bushes) might have been responsible for the increased distribution of porcupines and the colonization of new areas more than any other factors.

A second hypothesis is based on the influence of climatological factors on the pattern of distribution of animals. According to Veggiani (in press), the observed extension of the porcupine range northward is a biological response to warmer temperatures during a short-period fluctuation (Bruckner cycle), which has been recorded in the northern emisphere between the 1960s and the 1980s.

Long-distance wanderings and dispersion movements may be quite remarkable; for example, an adult female (13.1 kg), trapped and marked in the inner part of the Maremma Natural Park (Pigozzi, 1987, 1988), was killed in a wild boar (*Sus scrofa*) hunt 11 months later (I. Boschi, personal communication) at a line-of-sight distance of about 15 km from the site of capture. The animal had to cross a double-line railway, a very busy road (Via Aurelia), and probably several country roads. However, shorter-distance movements (up to 4-5 km) are carried out by crested porcupines on a daily basis during their foraging excursions (Pigozzi, 1990).

From the above information it is evident that crested porcupines did not become established in all regions, and that the overall range has substantially increased during the last decades, becoming much wider than previously believed. However, it should be emphasised that long-distance movements by dispersing individuals (see above) will tend to give an exaggerated picture of the range of the species at any one time. Furthermore, confounding variables may determine difficulties in comparing past and present distributions of a species. For example, one of the major difficulty is the amount of efforts devoted to finding animals in their habitat. This could be a serious problem in the case of the crested porcupine due to its secretive habits and nocturnal activity accomplished mainly in thick forests, which could have easily discouraged or negatively affected human efforts particularly in the past (e.g. it is rather striking the apparent absence of crested porcupines in some coastal habitats of Campania and Apulia, see distribution map in Scaramella, 1981). Finally, it is indeed difficult to document the pattern of increase in distribution, since there are no detailed baseline data for most regions prior to the 1979s, with which to compare the present distribution.

Conservation and management

Although there are at present no objective data indicating that crested porcupine populations are generally increasing, it is undoubtedly recogni-

zed that the porcupine's range has significantly increased northwards and eastwards during the last decade. On the basis of these indications it seems reasonable to conclude that the crested porcupine is not a species threatened with extinction, as suggested by van der Woude et al. (1969); on the contrary, the prospect for the long-term survival of this species in Italy is good.

As no information is practically available on the past and present estimate of numbers and population density, there is no background material for providing management plans on either local or national level. However, it may be useful to consider some of the problems that managers might have to solve in the near future. The main threat to crested porcupines is widespread poaching by people. The edibility of the porcupine meat, and to a lesser extent, the damage to cultivated crops continue to provide a strong incentive for poaching. The payment of compensation for proven agriculture damages could be useful to decrease the illegal hunting of porcupines by angry agricultures. Indeed, such payment is an aspect that would require careful planning and application. The increase of the penalties for poaching is unlikely to decrease illegal hunting by people that kill this large rodent exclusively for its meat. Yet, the loss of animals to poaching should not cause serious problems in the areas of more ancient colonization, where one would expect the existence of viable populations (sensu Soulé & Frankel, 1981). On the contrary, increasing poaching in areas of recent colonization could significantly reduced the frequency of contacts between sexually receptive individuals and probably affect the movements of dispersing porcupines. As a consequence, the impact of demographic, environmental and genetic stochastic factors would increase in importance due to the decrease in population size (Shaffer, 1981).

The common practice of using small dogs, trained to induce crested porcupines to leave the underground tunnels (Santini, 1980), is particularly dangerous not only for this rodent, but also for European badgers (*Meles meles* L.), which often share the same sett (Pigozzi, 1986). In fact, small dogs generally kill newly-born badgers when the latter are not actively defended by their mother (A. Nocenti, personal communication). Tougher actions (i.e. economic penalties and/or confiscation of the trained dogs) should be implemented against similar cases of illegal hunting.

It is becoming increasingly clear that the conservation and, more importantly, the management of a species cannot be achieved only by protective legislation. It is the role of the researcher to gather field data and present management plans. It is then up to the managers (and politicians) to choose what management action to take after a careful consideration of other relevant information areas (e.g. conservation priorities, interests and requirements of local people). At present there is a desperate need for studies concerning the ecology and ethology of the crested porcupine. Information on the habitat and food requirements, social and spatial organization of porcupines is essential to define management plans and to identify priorities for long-term research projects.

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